

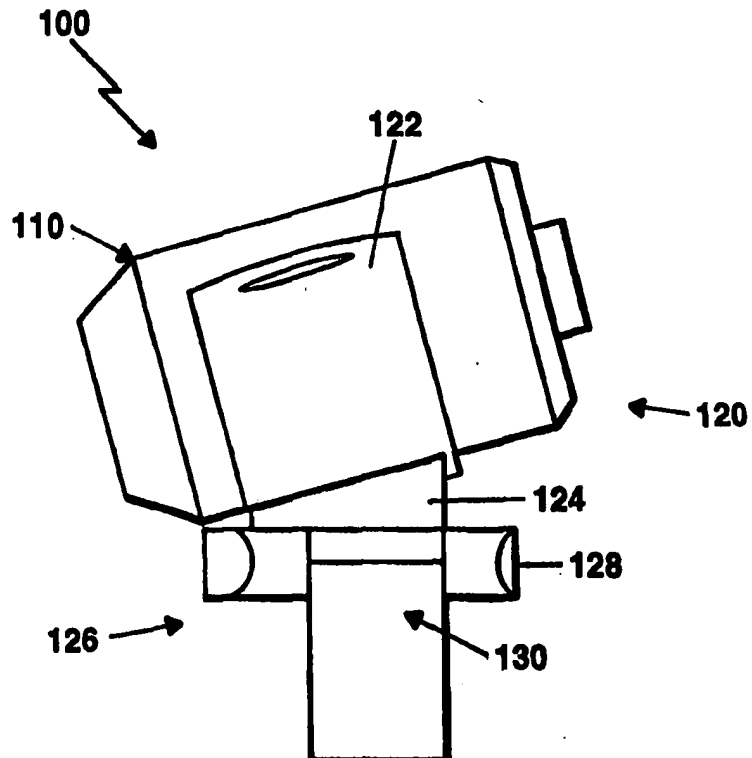


INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/US98/24000 (22) International Filing Date: 10 November 1998 (10.11.98) (30) Priority Data: 60/065,242 13 November 1997 (13.11.97) US 09/178,987 26 October 1998 (26.10.98) US (71) Applicant: AQUA COMMUNICATIONS, INC. [US/US]; 359 Green Street, Cambridge, MA 02139 (US). (72) Inventors: BOUDREAU, Ron; 77 Richardson Road, Boxboro, MA 01719 (US). GOODRICH, Elizabeth; 112 Beech Street, Roslindale, MA 02131 (US). SHAMEL, Rick; 4 Hickory Hill Trail, Acton, MA 01724 (US). TSAI, Jory; 14 Orchard Drive, Hudson, MA 01749 (US). (74) Agent: CONRAD, Philip, L.; Kudirka & Jobse, LLP, Two Center Plaza, Boston, MA 02108 (US).		(81) Designated States: JP, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report.</i> <i>With amended claims.</i>

(54) Title: FINGER-MOUNTABLE VIDEO CAMERA**(57) Abstract**

A finger-mountable video camera (100) is mountable on an individual's finger and is comprised of a mini-camera (110) and a camera adapter (120). The size and weight of the finger video camera is such that the dexterity of the individual's finger and hand are not significantly impaired, nor is the ability to access small spaces compromised. The mini-camera includes a light source, used to illuminate objects in the field of view of the camera lens, and a camera port, used to transmit video image data to another device. The camera adapter includes a camera holder (122), a camera holder base (124), and a finger ring (126). The camera holder is attached to the camera holder base, which in turn is attached to the finger ring. The camera holder base allows the camera holder to be rotated ± 60 degrees relative to the finger ring. The finger ring secures the finger-mountable video camera to an individual's finger, and is comprised of a base platform and finger securing element.



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FINGER-MOUNTABLE VIDEO CAMERA

FIELD OF THE INVENTION

5 The invention relates generally to video cameras. Specifically, the invention relates to portable miniature video cameras.

BACKGROUND OF THE INVENTION

10 This application takes priority from the provisional application filed in the United States Patent and Trademark Office on November 13, 1997, USPTO Serial No. 60/065,242, entitled FINGER VIDEO CAMERA.

15 Many situations call on an individual to view something located in a physically restrictive space. Such physical restrictions can take a variety of forms and may include a situation in which a space is too small to allow viewing of a desired object or mechanism, even though the object or
20 mechanism must be accessed by the individual's hand. In other circumstances, physical restrictions may include spaces which are not necessarily constrained in size relative to one's hand, but which are not easily or safely viewable, although these spaces could be easily and safely
25 accessed by one's hand.

 For example, an individual performing maintenance on a piece of machinery may be required to access an area within the machinery itself or in an external hard-to-see place. Such access may be required to allow damage to the area to be assessed, or to remove, replace, repair, or otherwise
30 manipulate the components. An inability of the maintainer to see the area in which he is reaching his hand may subject the individual to hazards from, for example, lose electrical wires, sharp edges, gears, or hot objects. Furthermore, the maintainer may not be able to adequately diagnose a problem if he can not view the area he is inspecting, e.g., corrosion inside a fuel tank. Additionally, he may not be able to efficiently conduct repairs on components not viewable by him, e.g., a wire harness within a car dashboard. Therefore, in such situations, it would be advantageous to be able to view such an area, which would otherwise not be viewable.

In another example, an insurance adjuster, who routinely travels to a variety of locations to view and inspect property damage, may encounter situations in which certain areas are not in plain view to him. Such an area might be the interior of a demolished automobile, which cannot be adequately
5 inspected from vantage points external to the car. However, the situation may be such that the adjuster could access with one hand the area he wishes to inspect within the demolished car. In other situations, safety may dictate that the adjuster not touch the item he is inspecting, e.g., where the item is physically unstable. For example, the inspector might want to see underneath
10 a collapsed roof, but only has adequate access to reach his hand inside the area. The need to preserve a scene may also dictate that an item remain undisturbed, although something not in plain view merits inspection. The ability of the adjuster to inspect critical areas is therefore compromised in situations where he can not otherwise view critical areas.

15

SUMMARY OF THE INVENTION

The invention is a finger-mountable video camera. The size of the video camera is such that it can be mounted to an individual's finger. Preferably, it is mounted such as to allow the individual to have use of that
20 finger and his hand to perform manipulations of objects in constrained spaces. Furthermore, in the preferred embodiment, no significant dexterity of the hand or fingers is lost due to the mounting of the finger-mountable video camera to the finger.

The finger-mountable video camera includes a mini-camera and a
25 camera adapter. The mini-camera includes a camera housing, a camera output port, image processing electronics, and a camera lens. In the preferred embodiment, the mini-camera also includes a light source. The camera housing encases the electronics, lens, light source, and camera output port. Also, the camera housing is made of lightweight and durable
30 materials to provide protection for the camera and light source against damage from occasional jarring and impact, which may occur from routine use.

The camera electronics process the video signals received by the camera lens, translate the signals into image data, and transmit the data to the camera port. The camera electronics, camera lens, and light source are known in the art and will not be discussed in detail herein. The light source, when turned on, illuminates the area within the field of view of the camera, which is also the area accessed by the hand on which the finger video camera is mounted. The light source allows the area to be visible on a display screen that receives the image data. The video camera port is a standard cable connector, in the preferred embodiment, providing a mechanism by which a camera cable can carry image data from the mini-camera to a video receiver. The camera port also receives a light source control signal, which turns the light source on and off. Additionally, the camera port receives a power on/off signal, which turns the camera on and off.

The camera adapter includes a camera holder, a camera holder base, and a finger ring. The camera holder allows the mini-camera to be secured within the camera adapter. In one embodiment, the miniature video camera is removable from the camera holder. In another embodiment, the miniature video camera and the camera holder are permanently attached. Using the finger ring, the finger-mountable video camera may be secured to a single finger on an individual's hand. The finger ring is comprised of a base platform secured to a finger-securing element. The camera holder base interconnects the camera holder and finger ring. In one embodiment, the camera holder base is maneuverable and allows the camera holder to rotate up to ± 60 degrees relative to the finger ring.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other features, objects, and advantages of the invention will be better understood by referring to the following detailed description in conjunction with the accompanying figures, as described below.

Figure 1 is a side view of the finger-mountable video camera in accordance with the preferred embodiment.

Figure 2 is a perspective view of the mini-camera portion of the finger-mountable video camera of Figure 1.

Figures 3A and 3B are a front perspective view and a top perspective view, respectively, of the camera adapter of the finger-mountable video
5 camera of Figure 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 is an illustration, from a side view, of the preferred embodiment of the finger-mountable video camera 100. The overall size and
10 weight of the finger-mountable video camera 100 are such that the finger-mountable video camera can be mounted on an individual's finger and not significantly impair the dexterity of that finger or the hand generally. Furthermore, the finger-mountable video camera 100 is small enough so that the individual's ability to access physically constrained areas is not
15 significantly compromised. That is, the profile of the camera 100 is small enough that a person's hand with the camera 100 mounted on a finger would fit into nearly any space that his or her hand would fit into without the camera 100.

In the preferred embodiment, the finger-mountable video camera 100 is
20 comprised of two primary elements, namely, a mini-camera 110 and a camera adapter 120. Generally speaking, the mini-camera 110 of the preferred embodiment is about the diameter of a typical adult's index finger and about half the length of the finger. The camera adapter 120 includes a camera holder 122, to which may be secured the mini-camera 110, a camera holder
25 base 124, and a finger ring 126. In one embodiment, the mini-camera 110 snaps into the camera holder 122 portion of camera adapter 120. Use of a holder material with a sufficient degree of elasticity, such as many commercial grade plastics, allows the mini-camera 110 to be attached to and removed from the camera holder 122 without any permanent deformation of camera
30 holder 122 occurring. Accordingly, the camera holder is expanded to allow the mini-camera 110 to be inserted and then contracts, in accordance with its elasticity, to partially encircle and securely grip mini-camera 100. While the

mini-camera 110 is removable from the camera holder 122 in the preferred embodiment, mini-camera 110 could also be integrated into or immovably secured to camera holder 122 in other embodiments. Returning to the preferred embodiment, the camera holder 122 attaches to the camera holder
5 base 124 which provides a maneuverable connection between the camera holder 122 and the finger ring 126. Finger ring 126 includes a base platform 128 and a finger-securing element 130, which are rigidly secured together. The camera holder base 124 immovably secures to the base platform 128. And, the finger-securing element 130 and base platform 128 operate in
10 combination to snugly attach the finger-mountable video camera to an individual's finger and, thereby, allow the camera to move with the finger.

Figure 2 is a perspective view of the mini-camera 110 of the preferred embodiment. As mentioned above, the mini-camera 110 is small in size and lightweight relative to a typical adult's finger, allowing the dexterity of the
15 finger and hand to remain substantially unimpaired. The mini-camera 110 includes a camera housing 112, which serves as the basic structure of the mini-camera 110 and encases and protects the components of the mini-camera 110 from damage that might otherwise occur from minor bumping during regular usage. For example, in the preferred embodiment, the camera
20 housing 112 is made of a durable and rigid plastic material.

The camera components include a camera lens 114 and camera electronics (not shown). The camera lens 114 is rigidly secured into a front portion of camera housing 112. Internal to camera housing 112, the camera electronics, including image processing circuitry, are securely located. The
25 camera electronics translate the image received through the camera lens 114 into video image data. The camera electronics then transmit the video image data out of the mini-camera 110 through a camera port 116 located at the rear of the camera housing 112 to a video receiver, e.g., a video display or video recorder. In the preferred embodiment, camera port 116 is an electrical
30 connector, to which a video cable 140 incorporating a compatible electrical connector 142 is attached to accomplish the transmission of video image data

to the video receiver. Such video cables and connectors are well known in the art and not described in detail herein.

A light source 118 is integrated into the front of the camera housing 112. In the preferred embodiment, the light source 118 is a light emitting diode (LED). The light source 118 is oriented, relative to the camera lens 114, in the housing 112 such that the light source 118 illuminates that area which the mini-camera 110 seeks to capture and, presumably, which the individual is manipulating with the hand or inspecting. The light source 118 is controlled remotely by the reception of a light source on or off signal via the camera port 116, but could also be controlled by other means, e.g., a switch on housing 112. Additionally, the mini-camera 110 is turned on and off remotely by the reception of a power on/off signal via the camera port 116, in the preferred embodiment, but could also be controlled by other means. The camera lens 114, light source 118, and camera electronics are known in the art and are commercially available components, which are not discussed in great detail herein.

Referring to Figure 3A, the camera adapter 120 of the preferred embodiment is shown from the front view. The camera adapter 120 includes a camera holder 122, a camera holder base 124, and a finger ring 126. The camera holder 122 allows a mini-camera 110 to be securely affixed to the adapter 120. The camera holder base 124 interconnects the camera holder 122 and finger ring 126. In the preferred embodiment, the interconnection provided by the camera holder base 124 between the camera holder 122 and finger ring 126 is a maneuverable interconnection. The maneuverable interconnection allows the camera holder 122 and a mini-camera 110 mounted therein to rotate axially up to $\pm 60^\circ$ with respect to finger ring 126 and centerline 144 and about center point 146 of Figure 3B. Arrows 148 and 150 depict the direction of rotation of camera holder 122 with respect to finger ring 126. In the preferred embodiment, the rotational connection between the camera holder base 124 and finger ring 126 includes a rigid connection between the camera holder 122 and camera holder base 124 and a rotatable connection between the camera holder base 124 and finger ring 126. The

camera holder base 124 includes a post (not shown) which extends downwardly from the camera holder base 124 and is mounted within an opening (not shown) in the finger ring 126 at center point 146. The post is rotatable within the opening, but is also secured within the opening such that the camera holder base 124 and finger ring 126 maintain their connection throughout typical operations. Other similar mechanisms may also be used to achieve a rotatable connection, or, alternatively, the connection between the camera holder 122 and finger ring 126 could be a rigid, i.e., non-rotatable, connection.

Finger ring 126 is comprised of a base platform 128 and a finger-securing element 130. The camera holder base 124, mentioned above, is secured to base platform 128 so that it is not removable. The base platform 128 and the finger-securing element 130 are used together to secure the mini-camera 110 to an individual's finger. As shown in Figure 3B, the base platform 128 is concave to allow a secure attachment across the top of an individual's finger. In the preferred embodiment, the finger-securing element 130 is a strap, which is capable of being tightened to adapt the finger-mountable video camera 100 to one's finger. Tightening strap 130 causes the base platform 128 to be pulled downward on to the top of the individual's finger, while the strap itself is simultaneously pulled upward from the bottom of the finger, creating a snug fit. Such a mechanism allows the finger-mountable video camera 100 to be tightly secured to one's finger, so the finger-mountable video camera does not become loose during operation. While the strap is shown in the preferred embodiment, it will be obvious to those skilled in the art that other types of securing elements would also suffice for securing the finger-mountable video camera 100 to one's finger.

While the invention has been shown and described with reference to a preferred embodiment thereof, it will be understood by those skilled in the art that various changes in form and detail may be made herein without departing from the spirit and scope of the invention, as defined by the appended claims. For example, while the camera and adapter are shown as two separate components, those skilled in the art will also recognize that these two

components could be integrated together to form one single component. Also, while the camera holder 122 is shown as a clip, the camera could be secured to the adapter by any of a variety of other means, such as a flexible strap. Furthermore, in the preferred embodiment, the camera holder base

5 124 provides a maneuverable connection between the mini-camera 110 and finger ring 126, but such a maneuverable connection could be achieved in a variety of other ways as well. Also, maneuverability of the mini-camera could include motion in other directions and to other degrees. Additionally, while video image processing is described as taking place within the mini-camera

10 110, it could also occur external to the mini-camera 110, e.g., at the display or an intermediate processor. And, while the mini-camera is described as a video camera in the preferred embodiment, a camera which captures still images may also be used in certain situations. Finally, while the present invention is described with respect to one camera embodiment, other

15 miniature cameras may also be used with the invention, so long as they do not substantially impair one's dexterity or significantly affect one's ability to access small areas.

What is claimed is:

CLAIMS

1. A finger-mountable camera apparatus, the apparatus comprising:
a miniature camera, wherein the camera is capable of receiving visual
5 images and transmitting visual image data; and
a camera adapter which secures the miniature camera to an
individual's finger, such that said apparatus, when mounted to
an individual's finger, is sufficiently small in size and lightweight
to preserve the dexterity of the individual's finger and hand.
- 10 2. The finger-mountable camera apparatus of claim 1, wherein the
miniature camera is a miniature video camera.
3. The finger-mountable camera apparatus of claim 1, further comprising
a light source, which illuminates the field of view of the camera.
4. The finger-mountable camera apparatus of claim 3, wherein the light
15 source is integrated into the miniature camera.
5. The finger-mountable camera apparatus of claim 1, wherein the
miniature camera is rotatably attached to the camera adapter.
6. The finger-mountable camera apparatus of claim 1, wherein the
camera adapter comprises:
20 a camera holder, within which the miniature camera is secured; and
a finger ring secured to the holder, the finger ring being removably
attachable to the individual's finger.
7. The finger-mountable camera apparatus of claim 6, wherein the
camera adapter further comprises a camera holder base, which secures the
25 finger ring to the camera holder.

8. The finger-mountable camera apparatus of claim 7, wherein the camera holder base provides a rotatable connection between the camera holder and the finger ring.
9. The finger-mountable camera apparatus of claim 6, wherein the
5 miniature camera is removably secured to the camera holder.
10. The finger-mountable camera apparatus of claim 6, wherein the camera holder is a clip with sufficient elasticity to be expanded to accept insertion of the miniature camera and to then contract and secure the miniature camera within the clip.
- 10 11. The finger-mountable camera apparatus of claim 6, wherein the camera holder is adjustable to allow the securing of differently sized or shaped miniature cameras.
12. The finger-mountable camera apparatus of claim 6, wherein the camera holder is maneuverably connected to the finger ring.
- 15 13. The finger-mountable camera apparatus of claim 12, wherein the movement of the camera holder relative to the finger ring is rotational about a point of connection between the camera holder and the finger ring.
14. The finger-mountable camera apparatus of claim 6, wherein the camera holder rotates up to ± 60 degrees relative the finger ring.
- 20 15. The finger-mountable camera apparatus of claim 6, wherein the finger ring is adjustable to allow securing of the apparatus to any one of a plurality of different size fingers.
16. The finger-mountable camera apparatus of claim 6, wherein the finger ring comprises:

a base platform, which attaches to the camera holder; and
a finger-securing element attached to the base platform, wherein the
finger securing element secures the base platform to the
individual's finger.

5 17. The finger-mountable camera apparatus of claim 16, wherein the
finger-securing element comprises a strap.

18. A camera finger adapter apparatus, which secures a miniature camera
to a individual's finger, the apparatus comprising:

10 a camera holder, within which the miniature camera is secured; and
a finger ring secured to the holder, the finger ring being removably
attachable to the individual's finger.

19. The camera finger adapter apparatus of claim 18, further comprising a
camera holder base, which secures the finger ring to the camera holder.

15 20. The camera finger adapter apparatus of claim 19, wherein the camera
holder base provides a rotatable connection between the camera holder and
finger ring.

21. The camera finger adapter apparatus of claim 18, wherein the camera
holder is adjustable to allow the securing of differently sized or shaped
miniature cameras.

20 22. The camera finger adapter apparatus of claim 18, wherein the camera
holder is maneuverably connected to the finger ring.

23. The camera finger adapter apparatus of claim 22, wherein the
movement of the camera holder relative to the camera finger ring is rotational
about a point of connection between the camera holder and the finger ring.

24. The camera finger adapter apparatus of claim 18, wherein the camera holder rotates up to ± 60 degrees relative the finger ring.
25. The camera finger adapter apparatus of claim 18, wherein the finger ring comprises:
- 5 a base platform, which attaches to the camera holder; and
a finger-securing element attached to the base platform, wherein the finger securing element secures the base platform to the individual's finger.
26. The camera finger adapter apparatus of claim 18, wherein the finger
10 ring is adjustable to allow securing of the apparatus to any one of a plurality of different size fingers.
27. A finger mountable camera apparatus the apparatus comprising:
a miniature video camera, wherein the camera is capable of receiving
video images and transmitting video image data;
15 a light source integrated into the miniature video camera, which illuminates the
field of view of the camera;
a camera holder, wherein the camera holder is a clip with sufficient elasticity to
20 be expanded to accept insertion of the miniature video camera and to then
contract and secure the camera within the clip;
a finger ring comprised of a base platform attached to an adjustable strap,
25 wherein the base platform and the strap secure the apparatus to an
individual's finger; and

a camera holder base, which rotatably attaches said camera holder to said base platform, wherein the camera holder base allows the camera holder to rotate ± 60 degrees relative to the finger ring.

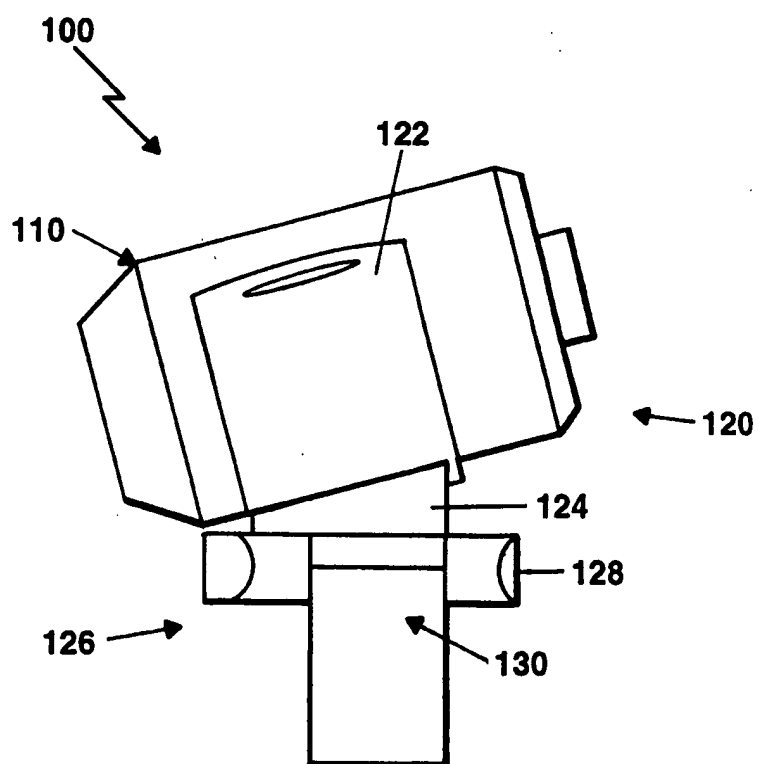
AMENDED CLAIMS

[received by the International Bureau on 29 March 1999 (29.03.99);
original claims 1 and 18 amended ; remaining claims unchanged (2 pages)]

1. A finger-mountable camera apparatus, the apparatus comprising:
a miniature camera capable of receiving visual images and transmitting
5 visual image data; and
a camera adapter to which the miniature camera is removably
securable, the adapter, in turn, being removably securable to a
portion of an individual's finger away from a tip of said finger, such
that the apparatus moves with the finger without impeding use of
10 the finger tip.
2. The finger-mountable camera apparatus of claim 1, wherein the
miniature camera is a miniature video camera.
3. The finger-mountable camera apparatus of claim 1, further comprising
a light source, which illuminates the field of view of the camera.
- 15 4. The finger-mountable camera apparatus of claim 3, wherein the light
source is integrated into the miniature camera.
5. The finger-mountable camera apparatus of claim 1, wherein the
miniature camera is rotatably attached to the camera adapter.
6. The finger-mountable camera apparatus of claim 1, wherein the
20 camera adapter comprises:
a camera holder, within which the miniature camera is secured; and
a finger ring secured to the holder, the finger ring being removably
attachable to the individual's finger.
7. The finger-mountable camera apparatus of claim 6, wherein the
25 camera adapter further comprises a camera holder base, which secures the
finger ring to the camera holder.

a base platform, which attaches to the camera holder; and
a finger-securing element attached to the base platform, wherein the
finger securing element secures the base platform to the individual's finger.

17. The finger-mountable camera apparatus of claim 16, wherein the finger-
5 securing element comprises a strap.
18. A camera finger adapter apparatus, by which a miniature camera may be
secured to an individual's finger, the apparatus comprising:
a camera holder, to which a miniature camera may be removably
secured; and
10 a finger ring secured to the holder, the finger ring being removably
attachable to a portion of the individual's finger away from a tip of said
finger, such that the camera moves with the finger without impeding use of
the finger tip.
19. The camera finger adapter apparatus of claim 18, further comprising a
15 camera holder base, which secures the finger ring to the camera holder.
20. The camera finger adapter apparatus of claim 19, wherein the camera
holder base provides a rotatable connection between the camera holder and
finger ring.
21. The camera finger adapter apparatus of claim 18, wherein the camera
20 holder is adjustable to allow the securing of differently sized or shaped
miniature cameras.
22. The camera finger adapter apparatus of claim 18, wherein the camera
holder is maneuverably connected to the finger ring.
23. The camera finger adapter apparatus of claim 22, wherein the movement
of the camera holder relative to the camera finger ring is rotational about a
point of connection between the camera holder and the finger ring.

**Figure 1**

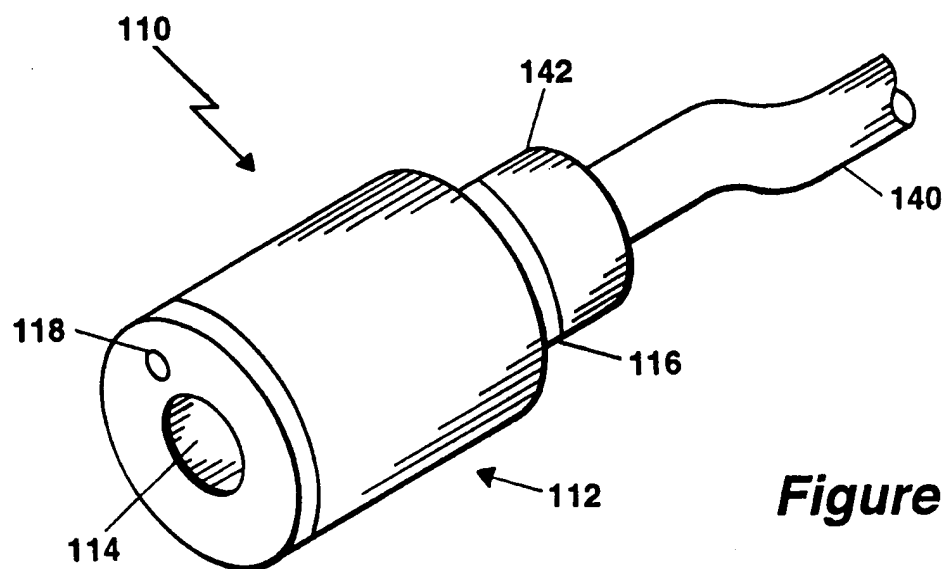
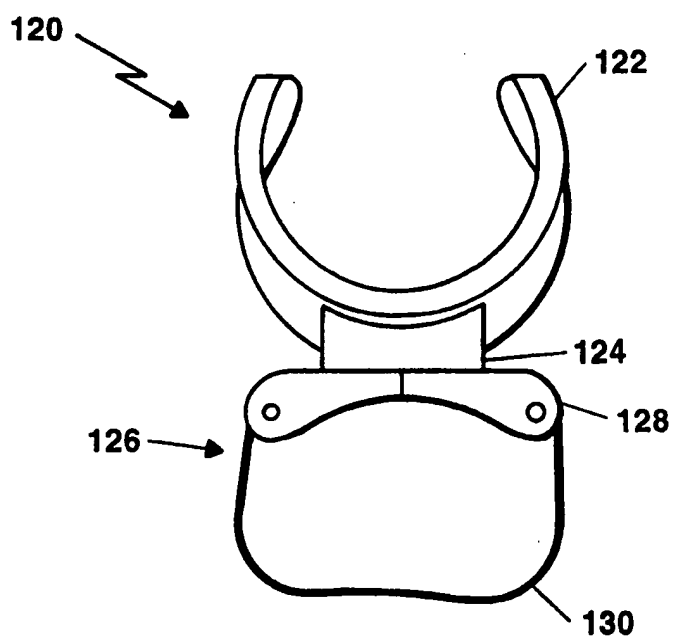
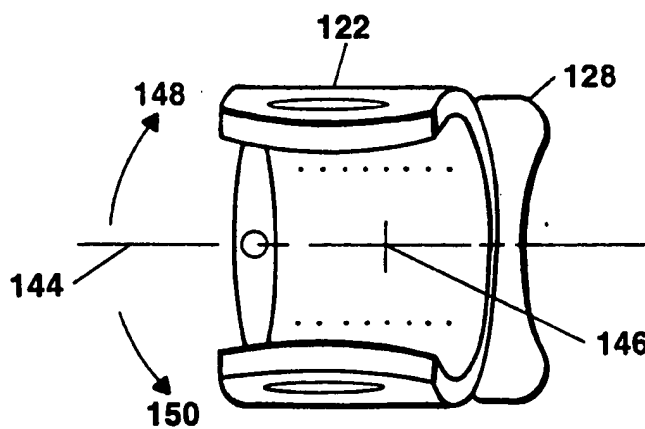


Figure 2

3/3

**Figure 3A****Figure 3B**

INTERNATIONAL SEARCH REPORT

Inter: national Application No

PCT/US 98/24000

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 H04N5/225 H04N7/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 5 079 629 A (OZ DAN) 7 January 1992 see column 2, line 45 - column 4, line 44 ---	1-4 18,27
X A	WO 96 27991 A (HELFGOTT & KARAS P C ; S NEW VISION SYSTEMS LTD NV (IL); OZ DAN (IL) 12 September 1996 see page 4, line 17 - line 29 see page 6, line 12 - page 11, line 18 ---	1-4 18,27
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

5 February 1999

Date of mailing of the international search report

16/02/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Wentzel, J

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 98/24000

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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